

What is claimed is:

1 1. In an alternate polymer extrusion system of the kind that includes a first extruder,
2 a second extruder, a first gear pump coupled to the first extruder, a second gear pump coupled to
3 the second extruder, a die in communication with the first and second gear pumps, a first melt
4 path downstream of the first gear pump, a second melt path downstream of the second gear
5 pump, and a convergence of the first and second melt paths; the improvement comprising a pair
6 of constrictions, one of which is defined in each of the first and second melt paths proximate to
7 the convergence, whereby the constrictions increase the pressure required to force melt past each
8 constriction to the convergence to thereby at least substantially reduce drool of melt out of the
9 first and second melt paths to the convergence upon slowing or stopping of one of the gear
10 pumps.

1 2. In the alternate polymer extrusion system of claim 1, the improvement further
2 comprising said convergence being located in the die.

1 3. In the alternate polymer extrusion system of claim 2, the improvement further
2 comprising the constrictions being located in the die.

1 4. In the alternate polymer extrusion system of claim 1, the improvement further
2 comprising said convergence being at or closely proximate an outlet end of the die.

1 5. In the alternate polymer extrusion system of claim 1, the improvement further
2 comprising a controller operatively connected to control at least one extrudate dimension-
3 affecting parameter of the extrusion system, a sensor for detecting an extrudate dimension
4 affected by the at least one dimension-affecting parameter, the controller including a lag time
5 correction causing the controller to vary correctively the at least one dimension-affecting
6 parameter in anticipation and correction of an undesired dimensional effect.

1 6. In the alternate polymer extrusion system of claim 1, the improvement further
2 comprising a controller coupled to the first and second gear pumps to vary the speed of the first
3 and second gear pumps, the controller being programmable to vary the speed and timing of the
4 first and second gear pumps to compensate slower increases in the movement of melt past each
5 constriction than would occur in the absence of the constriction by virtue of compression of the
6 melt with increased pressure between the gear pump and the constriction, and to compensate
7 slower decreases in the movement of the melt past each constriction than would occur in the
8 absence of the constriction by virtue of expansion of the melt with decreased pressures between
9 the gear pump and the constriction.

1 7. In the alternate polymer extrusion system according to claim 6, the improvement
2 further comprising a sensor to measure a dimension of an extrudate during extrudate production,
3 the sensor being operatively coupled to the controller, and lag time programming in the
4 controller associating a dimensional anomaly with a change of speed of at least one of the gear
5 pumps, whereby repetitive such gear pump speed changes can be compensated by the controller
6 to effect reduction or elimination of the anomaly in subsequent gear pump speed changes.

1 8. In the alternate polymer extrusion system according to claim 7, the controller
2 further comprising a display monitor, the controller being programmed to cause display on the
3 monitor of a plurality of curves at least one of which represents said dimension as a function of
4 distance along the extrudate.

1 9. In the alternate polymer extrusion system according to claim 8, the controller
2 being programmed to cause display on the monitor at least one of a dimension-affecting
3 parameter value as a function of distance along the extrudate.

1 10. In the alternate polymer extrusion system according to claim 9, the dimension-
2 affecting parameter of the display being at least one of gear pump speed, air pressure within a
3 hollow extrudate, pressure differential between the interior and exterior of a hollow extrudate
4 and speed of a puller.

1 11. An alternate polymer system comprising first and second extruders including first
2 and second gear pumps, first and second means for conveying melt from each of the first and
3 second gear pumps to a convergence, means for constricting each of the first and second means
4 for conveying, a die in communication with the first and second gear pumps, and means for
5 controlling the speed of the first and second gear pumps.

1 12. The alternate polymer extrusion system according to claim 11, wherein the means
2 for controlling the speed of the first and second gear pumps comprises means for causing an
3 increase in speed of one of the first and second gear pumps and a decrease in speed of the other
4 of the first and second gear pumps.

1 13. The alternate polymer extrusion system according to claim 12, wherein the means
2 for causing an increase in the speed of one of the first and second gear pumps and a decrease in
3 speed of the other of the first and second gear pumps comprises means for providing a speed
4 increase increment to compensate for elasticity of melt in the means for conveying between the
5 one of the first and second gear pumps and the means constricting that means for conveying.

1 14. The alternate polymer extrusion system according to either claim 12 or 13,
2 wherein the means for causing an increase in speed of one of the first and second gear pumps and
3 a decrease in speed of the other of the first and second gear pumps comprises means for
4 providing a speed decrease increment to compensate for elasticity of the melt in the means for
5 conveying between the other gear pump and the means constricting that means for conveying.

1 15. The alternate polymer extrusion system according to claim 14, further comprising
2 sensor means for detecting a dimension of an extrudate emerging from the die, the sensor means
3 being operatively coupled to the means for controlling, means for determining a time lag
4 between a speed change in at least one of the first and second gear pumps and a resulting
5 undesired dimensional change sensed by the sensor means, whereby the means for controlling is
6 programmable to make corrective gear pump speed control in anticipation and avoidance of a
7 similar undesired dimensional change.

1 16. The alternate polymer extrusion system according to claim 11, wherein in
2 addition to controlling the speed of the first and second gear pumps, the means for controlling
3 comprises means for controlling at least one further dimension-affecting parameter of the
4 extrusion system.

1 17. The alternate polymer extrusion system according to claim 16, further comprising
2 means for maintaining a pressure differential between an interior and an exterior of a hollow
3 extrudate being formed by the system, said further dimension-affecting parameter being the
4 value of the pressure differential.

1 18. The alternate polymer extrusion system according to claim 16, further comprising
2 an air supply and a means for introducing air to the interior of a hollow extrudate being formed
3 by the system, said further dimension-affecting parameter controlled by the control means being
4 the air pressure in the hollow extrudate.

1 19. The alternate polymer extrusion system according to claim 16, wherein the
2 control means has an output for control of a puller, said further dimension-affecting parameter
3 controlled by the control means being the speed imparted to the extrudate by the puller.

- 1 20. A method of alternate polymer extrusion comprising:
- 2 (a) providing a first extruder including a first gear pump,
- 3 (b) providing a second extruder including a second gear pump;
- 4 (c) supplying a first material to the first gear pump;
- 5 (d) supplying a second material to the second gear pump;
- 6 (e) directing the first material along a first path from the first gear pump;
- 7 (f) directing the second material along a second path from the second gear
- 8 pump;
- 9 (g) providing a convergence of the first and second paths;
- 10 (h) directing at least one of the first and second materials from the
- 11 convergence of the first and second paths to an outlet of a die;
- 12 (i) extruding the at least one material by forcing through the die;
- 13 (j) constricting each of the first and second paths proximate the convergence;
- 14 and
- 15 (k) varying the speed of the first and second gear pumps to vary the rate of
- 16 flow of the first and second materials past the constriction to the convergence.

- 1 21. The method of alternate polymer extrusion according to claim 20, further
- 2 comprising:
- 3 (l) repeatedly varying the speed of each of gear pumps to repeatedly vary the
- 4 content of the first and second materials in an extrudate emerging from the die.

- 1 22. The method of alternate polymer extrusion according to claim 21, further
- 2 comprising:

1 23. The method of alternate polymer extrusion according to either of claims 21 or 22,
2 further comprising initially imparting a compensatory decrease in the speed of each gear pump in
3 addition to each speed decrease of that pump for decreased delivery of a melt of one of the first
4 and second materials therethrough, the compensatory decrease in speed compensating for the
5 initial expansion of melt between the gear pump and one of the constrictions as that pump slows
6 or stops.

1 24. The method of alternate polymer extrusion according to claim 21, further
2 comprising determining a dimension of an extrudate emerging from the die, and controlling a
3 dimension-affecting parameter of the alternate polymer extrusion method to control said
4 dimension.

1 25. The method of alternate polymer extrusion according to claim 24, wherein the
2 dimension-affecting parameter is the speed of at least one of the gear pumps.

1 26. The method of alternate polymer extrusion according to claim 25, further
2 comprising determining the lag time between a pump speed alteration and a resultant dimension
3 variation, and wherein controlling the dimension-affecting parameter includes timing corrective
4 pump speed of the at least one pump to control the dimension at a location along the extrudate
5 that is subsequently extruded.

1 27. The method of alternate polymer extrusion according to claim 24, wherein
2 controlling a dimension-affecting parameter comprises controlling a pressure differential
3 between the interior and the exterior of a hollow extruder.

1 28. The method of alternate polymer extrusion according to claim 24, wherein
2 controlling a dimension-affecting parameter comprises controlling the speed of a puller.

1 29. A die for an alternate polymer extrusion system comprising:
2 (a) a first melt path leading into the die from a first input opening;
3 (b) a second melt path leading into the die from a second input opening;
4 (c) a convergence of the first and second melt paths in the die;
5 (d) a constriction in each of the first and second melt paths proximate and
6 upstream of the convergence, and;
7 (e) an output opening for the emergence of an extrudate.

1 30. The die for an alternate polymer extrusion system according to claim 29, further
2 comprising a passage downstream of the convergence and leading to the output opening, the
3 passage being of sufficient length to permit polymer melt flowing from the convergence to the
4 output to have its cross-sectional shape established.

1 31. The die for an alternate polymer extrusion system according to claim 29, further
2 including at least one further melt path and at least one further constriction in the one further
3 melt path.